2011 Annual Report: Banking on Stem Cells

News at CIRM

Banking on Stem Cells

Frozen in two California labs sit 20 new human embryonic stem cell lines created by CIRM grantees and certified for use by other CIRM researchers. These lines, and others created by California scientists, could provide an invaluable tool for researchers throughout California, helping to speed the search for therapies and treatments to deadly diseases. But there's a problem; how do you get the cells to the researchers who need them?

"It's not just 'here, take some cells,'" said Geoff Lomax, CIRM senior officer for scientific and ethical standards. "The fundamental problem that I'm hearing is people have these cells but they lack the capacity to distribute them to their colleagues."

The problem is largely one of resources. At an institution that has cells to distribute, such as UCLA or UCSF, someone has to maintain those cells and authenticate that they are what they are supposed to be before putting them in the mail. That takes time and resources. It can also take significant time and paperwork to negotiate the use of the cells between institutions. The people who created those cells don't necessarily have the resources to manage that distribution and the scientists who want the cells can't always wait. (Here is a list of the 20 lines derived by CIRM grantees.)

CIRM's solution to this laboratory logjam takes the form of a three-part initiative. The first part will bank cells created by CIRM grantees and make them easily accessible to California scientists and their collaborating partners worldwide. The other two portions focus on creating new disease-specific cell lines that are proving valuable in understanding diseases, and identifying new therapies. Creating this centralized resource to handle the distribution, the paperwork and the creation of new lines will allow scientists to keep their focus on what is most important—using those cells to develop new therapies. (Here is CIRM's announcement about this initiative.)

Mimicking Disease

Disease-specific lines are comparatively new in this field of research and owe their origins to the 2007 discovery by Shinya Yamanaka that adult cells can be reprogrammed to an embryonic-like state—so called induced Pluripotent Stem (iPS) Cells. Since that time, researchers have been using the technique to develop laboratory models of disease and are beginning to develop ways to use them for drug screens.

The starting blocks for disease models are cells from patients who have a particular disease or condition. Scientists direct the iPS cells to mature in the lab—into neurons in Alzheimer's disease for example—and see how these cells behave differently from those derived from individuals with no signs of the disease.

Scientists have reprogrammed iPS cells from people with Alzheimer's and Parkinson's diseases, autism, schizophrenia, heart defects and many other disorders. In many cases, those cells, matured into the cell type that is disrupted in the disease itself, show visible differences compared to cells created from people without the disease. Neurons created from people with forms of autism, for example, show unusual signaling patterns and differences in how they form connections with other cells. (Read Spotlight on Autism)

That first glimpse has not only revealed to scientists what it is that goes wrong in the disease, it also provides a potential pathway to test drugs that may be able to correct the problem or at least mitigate it. Clearly, finding a drug that appears to work in human cells in the laboratory is a long way from showing it will be equally effective in people, but these cell lines at least give researchers a place to start looking.

These personalized iPS cells also provide a way of understanding why some people have negative reactions to drugs that are safe in others. Creating a repository of iPS cells from a wide variety of people creates a way of studying drug toxicity and predicting which people might have a negative response. Companies developing drugs could use this information to find ways to reduce the likelihood of side effects, or to stop development of drug candidates that produce particularly severe effects. This could help ensure that drugs on the market are more likely to have a better safety profile.

Learning how to share

Although many of the disease-focused lines already exist, exchange is often restricted due to the amount of paperwork involved in transferring the cells between institutions. This difficulty with sharing disease-specific lines means that throughout California teams of researchers are often replicating the same work: identifying the appropriate patients, getting informed consent from those patients, obtaining and storing samples, and creating the iPS cells.

"Having repositories with well characterized resources, where they deal with all the paperwork and can provide materials quickly, that's great."

- Lawrence Goldstein

Lawrence Goldstein, a stem cell scientist at the University of California, San Diego, said there are good models in science to show that centralized resources can help speed up research. “Having repositories with well characterized resources, where they deal with all the paperwork and can provide materials quickly, that’s great,” Goldstein said. “Those have led to a lot of great discoveries.”

He added that for an iPS cell repository to be successful access will have to be easy, need to include the medical information about the anonymized donors, use methods to create the lines that are consistent, and the lines will have to be very well characterized—the researchers must run tests to make sure the cells are truly the type they think they are.

One portion of CIRM’s banking initiative will recruit patients and family members to donate and store tissue samples along with information about their anonymized health data. Another portion will fund a group to use a uniform system to create cell lines from those tissues. The final part supports the banking and distribution of these disease-specific cells as well as any embryonic stem cells that have been generated in the state.

The CIRM bank effectively creates a one-stop shop for cell lines that will focus on common diseases such as Alzheimer’s, autism, autoimmune diseases, heart disease, diabetes, respiratory disorders and others. These will complement a partnership between CIRM and the National Institute for Neurological Disorders and Stroke (NINDS) of the National Institutes of Health (NIH) to bank cell lines from people with Parkinson’s, Huntington’s and Lou Gehrig’s disease (Amyotrophic Lateral Sclerosis). Collectively, the CIRM cell banking initiatives should reduce the time countless patients with many diseases have to wait for stem cell-derived therapies.

The end result can’t come soon enough for Jeanne Loring at the Scripps Research Institute, whose lab creates and analyses iPS cell lines. For her work in the lab she characterized this initiative as “a life changer.” And that should translate to accelerated progress toward potential lifesavers for patients.
